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Usability Study of Dehy Pro (Dehydration Prevention) Application to Prevent Diarrhea Dehydration among Children in Jember

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ABSTRACT

Introduction: *Diarrhea is preventable yet in Indonesia, it is still the second leading cause of under five's death. Dehydration is the main factor in most diarrhea-related fatalities in children. There is a requirement for health education initiatives that prioritize the prevention of diarrhea dehydration through the utilization of mobile health applications.* ***Objectives:*** *This study aimed to evaluate the usability and acceptance of Dehy Pro Application in preventing diarrhea dehydration among children in Jember.* ***Methods:*** *This study involved 56 respondents consisting of 6 experts and 50 mothers with children under five. Mothers were gathered using purposive sampling. Application development is carried out through several stages, including a literature study, design stage, development stage, and dissemination stage. The usability of Dehy Pro was assessed using the Mobile Application Usability Questionnaire (MAUQ).* ***Results:*** *The three items with the highest mean according to the expert's assessment were "The app was easy to use" (6.85/7), "It was easy for me to learn to use the app" (6.85/7), and "The app would be useful for my health and wellbeing" (6.85/7). Meanwhile, according to the respondent's assessment, there were four items with the highest mean, including "The app was easy to use" (6.94/7), "It was easy for me to learn to use the app" (6.92/7), "I would use this app again" (6.92/7), and "The app helped me manage my health effectively" (6.92/7).* ***Conclusions:*** *Dehy Pro as an application to increase the role of parents in preventing diarrhea dehydration in children has good usability and acceptance although it still needs some improvements.*

Introduction

Diarrhea is an infectious disease that is actually very preventable and has a high cure rate. However, the fact is that, until now, diarrhea is still the second-highest cause of under-five mortality in the world, especially in developing countries after pneumonia. Based on UNICEF data, in 2019, diarrhea accounted for 9% of all under-five mortality rates in the world. In other words, diarrhea causes more than 1300 under-five deaths every day, or 484,000 under-five deaths each year (UNICEF, 2022). Troeger et al. (2018) added that every year there are 260 million cases of diarrhea in infants and children under five years of age worldwide, and more than 1.5 million of these cases develop into a serious condition and require treatment at the hospital.

According to the 2021 Indonesia Health Profile, diarrhea is actually the first highest contributor to mortality in under-fives in Indonesia, followed by pneumonia (KEMENKES RI, 2022). As many as 10.3% of deaths in children under five in Indonesia are caused by diarrhea, higher than the global death rate due to diarrhea in children under five. The incidence of diarrhea and the morbidity rate of

diarrhea in children under five in Jember Regency are still quite high. Based on Jember District Health Profile data for 2020, there were 29,512 cases of diarrhea among toddlers receiving services from PUSKESMAS in Jember District. Although there were no reported deaths due to diarrhea in 2020, the morbidity rate of diarrhea in children under five in Jember Regency reached 843 per 1000 population in that year (Dinas Kesehatan Kabupaten Jember, 2021).

Dehydration is the main cause of diarrheal death in children, especially severe dehydration (Acácio et al., 2019; Hartman et al., 2022; Van Der Westhuizen et al., 2019). A child's body has more fluid composition than an adult's body, so a child will be more susceptible to changing conditions of fluid in the body. It can be inferred that dehydration in children will have a worse impact than in adults. For this reason, children who experience diarrhea need proper and

immediate treatment because the dangers caused by dehydration can lead to death. During diarrhea, children lose fluids and electrolytes in large quantities, so the main principle in treating diarrhea in children is to adequately replace lost fluids as soon as possible, starting at home.

Mothers have a very crucial role in caring for children with diarrhea. Actions taken by mothers related to efforts to care for children with diarrhea greatly determine the further development of the disease. A study proves that parents who provide sufficient fluids at home ensure that the majority of their children with diarrhea do not experience dehydration. Conversely, parents who do not provide adequate fluids for their children experience mild-moderate dehydration (Zubaidah; Maria, 2020). Therefore, parents, especially mothers, need to be equipped with good knowledge regarding the management of giving fluids at home to children who experience diarrhea so that dehydration can be prevented.

In today's modern era, where technology is developing so rapidly, health information can be provided to the public through various applications that can be accessed via smartphones. Smartphone-based mobile health applications globally have been widely used as an effective medium for health promotion and health education in increasing healthy behavior (Han & Lee, 2018). Moreover, in 2021 there will be around 76.26% smartphone users in Indonesia (Statista Research Dep, 2023). Even though the number of smartphone users in urban areas dominates, the number of smartphone users in rural areas has reached more than 50.39% of the total rural community (Adisty, 2022).

Even though many health applications have been created that can be accessed anywhere and anytime via smartphones, until now there has been no similar application used to increase parental knowledge and behavior in preventing diarrhea dehydration. Health education to prevent diarrheal dehydration, which has been carried out so far, only covers general diarrhea management materials, so parents are not guided to carry out initial treatment at home according to the conditions of each child. Yet according to Sartori et al. (2022) personalization is an important factor that can determine the effectiveness of an application in increasing the healthy behaviors of users. The personalization means that the application is designed based on the user's personal needs. Dehy Pro was designed based on the Manajemen Terpadu Balita Sakit (Integrated Management of Sick Children) developed by KEMENKES RI (2019) so that parents can screen for the degree of dehydration associated with diarrhea independently and receive guidance for carrying out initial treatment of diarrhea according to the degree of dehydration of children, such as increasing oral fluid intake for children, make and give sugar and salt solutions, and when should parents take their children to the PUSKESMAS or the nearest hospital. Therefore, the purpose of this study was to evaluate the use of Dehy Pro in preventing dehydration diarrhea in children.

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Methods

This study used a quantitative approach involving six experts and 50 mothers with children under five. The total number of respondents in this study was 56

The experts involved were selected based on their educational background and work experience. The six experts involved consisted of 1 lecturer with a master's degree in communication science who had extensive experience in the field of computer networks and programming; 2 lecturers with a master's degree in pediatric nursing; 1 lecturer with a specialist degree in pediatric nursing; and 2 PUSKESMAS nurses who were directly responsible for the implementation of the MTBS program in PUSKESMAS. Mothers who were respondents in this study were selected by purposive sampling with inclusion criteria: having children under five years, living in Karangrejo Village, Sumbersari District, Jember Regency, using smartphones, can read and write, and being willing to follow the research to completion.

This research begins with developing smartphone-based Dehy Pro application that involves an information system expert. The development of the Dehy Pro application was carried out in 4 main stages, namely Define, Design, Develop, and Disseminate. The explanation of each level is as follows:

1. Define

In the define stage, the researchers compiled menus and contents of Dehy Pro application using credible and up-to-date literature, one of which MTBS.

2. Design

At the design stage, researchers collaborate with experts in the field of information system to design application prototypes.

3. Develop

At the development stage, an expert appraisal was carried out to assess the feasibility of the application using the mHealth App Usability Questionnaire (MAUQ). The experts involved in the expert appraisal consisted of one lecturer with communication science expertise, three pediatric nursing lecturers, and two nurses in charge of the Integrated Management of Sick Children (MTBS) at PUSKESMAS. The experts were asked to provide opinion on four aspects of the application, namely: the appearance of the application, the language used, the application menu, and the ease of using the application. Researchers made improvements and application development according to the expert's recommendations, followed by testing the application prototype on ten mothers who have children under five

4. Disseminate

In the dissemination stage, the application was introduced to 50 respondents.

The menus available in the Dehy Pro application are (1) **Child profile**, in this menu, parents can fill in the child's identity and include the child's name, gender, and date of birth; (2) **Diarrhea risk screening**, this menu displays 9 questions compiled by researchers based on theories and previous research results that relate to factors of a role in the diarrhea of children under five, such as the history of breastfeeding, clean and healthy living behavior, and factors of mothers and child's environment. The risk of diarrhea in children under five is classified into 4 categories, namely: strong low risk, low

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risk, moderate risk, and high risk; (3) **Education**, on this menu parents get information related to diarrhea, prevention of diarrhea, diarrhea dehydration, signs of diarrhea dehydration, treatment of diarrhea dehydration based on the degree of diarrhea dehydration, as well as several educational videos such as videos on how to check child's skin turgor, make salt sugar solution, and give zinc tablets; (4) **Dehydration Diarrhea**, this menu displays 7 questions compiled by researchers based on the classification of diarrhea dehydration and its signs according to the MTBS 2019. After filling in the questions on diarrhea dehydration screening, parents can see the results of the degree of dehydration in children under five along with recommendations for handling them. Each recommendation for handling dehydration and diarrhea is prepared based on the MTBS 2019; (5) **Contact nurses**, there are three names and contact numbers for researchers who also have a nursing education background that parents can contact if they want to ask questions about children's health. This menu is also added to the location of the nearest health service around Sumbersari District, Jember Regency. The appearance and menu of Dehy Pro can be seen in Figure 1:

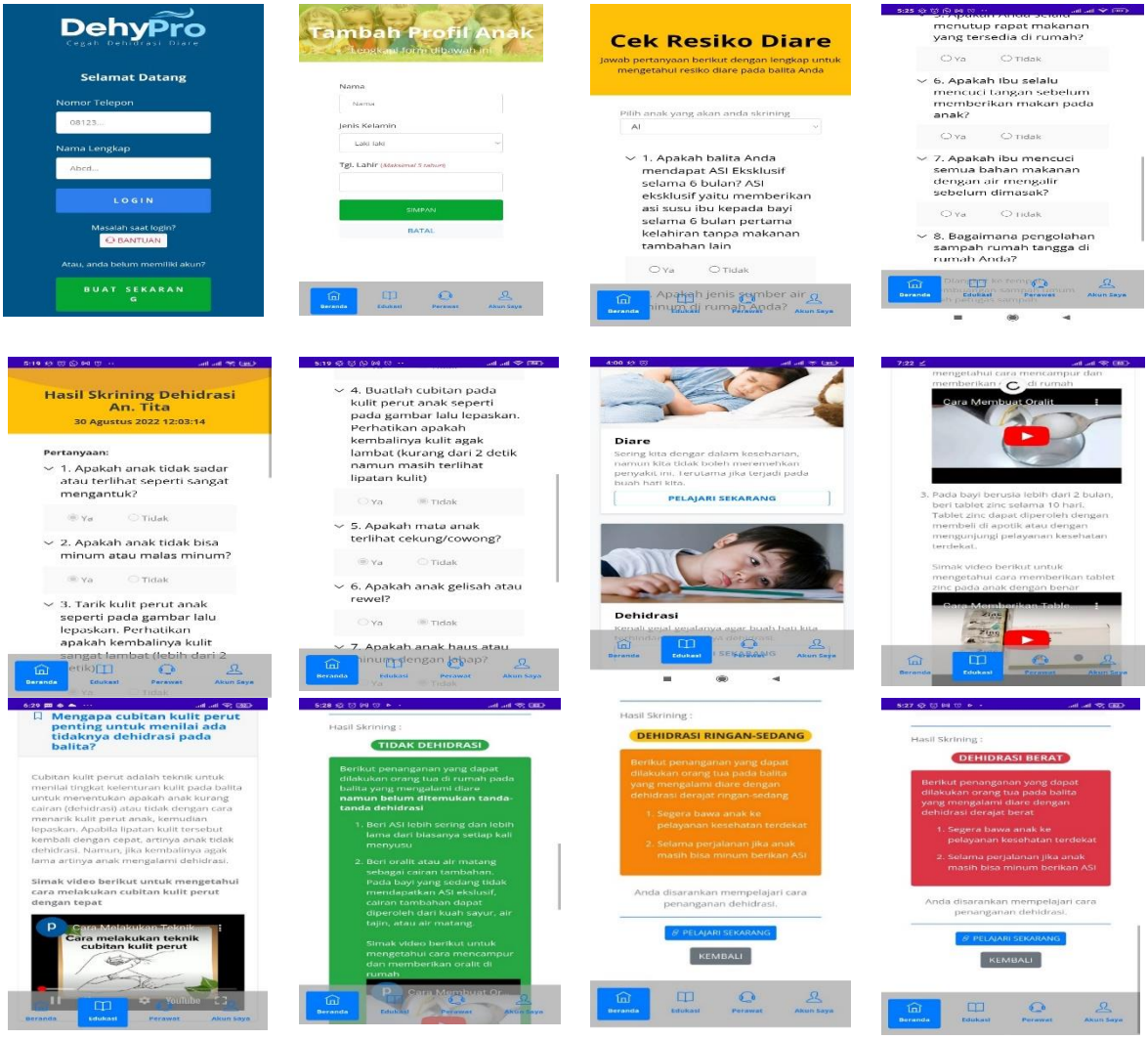

Figure 1. Menus of Dehy Pro

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The MHealth App Usability Questionnaire (MAUQ) was developed by Zhou et al. (2019) and consists of 18 questions that use the Likert scale answer form with a range from 1 to 7, where 1 means strongly disagree and 7 means strongly agree. The question items on MAUQ measure aspects of ease of use of the application, application navigation, clarity of information contained in the application, internet usage when accessing the application, satisfaction in using the application, and the usefulness of the application for the user's health. To determine the usefulness of the application, the responses to each question item are totalled, and then the average is taken. The higher the average of all question items, the higher the usability of the application. This research has received an ethically proper certificate from the KEPK of the Faculty of Dentistry, University of Jember, with number 1576/UN25.8/KEPK/DL/2022.

Results

Table 1 shows that five experts have expertise in nursing, and one expert is an expert in communication science. Four experts work in the field of education as university lecturers, and two experts work as nursing practitioners. Five (83%) experts were aged 30-35 years, and four (67%) experts were female. Most (62%) users have an age range of 26–33 years. The majority of users have a senior high school education (48%), and they have one child (44%).

Table 1. Respondents' Demographic Characteristics

Characteristics of respondents	n (%)
Expert(n=6)	
Expertise	
Nursing	5 (83%)
Informatics	1 (17%)
Field of work	
Education	4 (67%)
Service	2 (33%)
Level of education	
Bachelor of Nursing	1 (17%)
Master of Nursing	2 (32%)
Pediatric Nursing Specialist	1 (17%)
Community Nursing Specialist	1 (17%)
Master of Communication Science	1 (17%)
Age	
30-35	5 (83%)
35-40	1 (17%)
Gender	
Male	2 (33%)
Female	4 (67%)
Users (n=50)	
Age	
18-25	12 (24%)
26-33	31 (62%)
>33	7 (14%)

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Level of education	
Primary School	8 (16%)
Junior High School	14 (28%)
Senior High School	24 (48%)
University	4 (8%)
Number of children	
1	22 (44%)
2	18 (36%)
3	8 (16%)
>3	2 (4%)

Table 2 shows the results of the assessment of the usefulness of Dehy Pro using MAUQ by both experts and nonexperts. The three items with the highest mean according to the expert's assessment were "The app was easy to use" (6.85/7), "It was easy for me to learn to use the app" (6.85/7), and "The app would be useful for my health and wellbeing" (6.85/7). Meanwhile, according to the respondent's assessment, there were four items with the highest mean, including "The app was easy to use" (6.94/7), "It was easy for me to learn to use the app" (6.92/7), "I would use this app again" (6.92/7), and "The app helped me manage my health effectively" (6.92/7). There are two items with the lowest mean in the expert's assessment: "The app is adequately acknowledged and provided information to let me know the progress of my action." (6.14/7), "I could use the app even when the Internet connection was poor or not available" (6.00/7). In the respondent's assessment, there were also two items that received the lowest mean, namely "This app has all the functions and capabilities I expected it to have" (6.40/7), and " I could use the app even when the Internet connection was poor or not available." (5.62/7).

Table 2. Assessment of The MHealth App Usability Questionnaire (MAUQ) by Respondents

No.	Statement	Mean	
		Experts	Users
1.	The app was easy to use	6.85	6.94
2.	It was easy for me to learn to use the app	6.85	6.92
3.	The navigation was consistent when moving between screens.	6.57	6.86
4.	The interface of the app allowed me to use all the functions (such as entering information, responding to reminders, viewing information) offered by the app.	6.57	6.78
5.	Whenever I made a mistake using the app, I could recover easily and quickly.	6.71	6.84
6.	I like the interface of the app.	6.42	6.76
7.	The information in the app was well organized, so I could easily find the information I needed.	6.71	6.80
8.	The app adequately acknowledged and provided information to let me know the progress of my action	6.14	6.82
9.	I feel comfortable using this app in social settings	6.42	6.72
10.	The amount of time involved in using this app has been fitting for me	6.57	6.76
11.	I would use this app again	6.57	6.92
12.	Overall, I am satisfied with this app	6.71	6.76

13.	The app would be useful for my health and wellbeing	6.85	6.86
14.	The app improved my access to healthcare services	6.71	6.78
15.	The app helped me manage my health effectively	6.42	6.92
16.	This app has all the functions and capabilities I expected it to have	6.28	6.40
17.	I could use the app even when the Internet connection was poor or not available	6.00	5.62
18.	This mHealth app provides an acceptable way to receive healthcare services, such as accessing educational materials, tracking my own activities, and performing self-assessment	6.42	6.62

Table 3 shows experts' written opinion, both positive and negative. Most experts liked the look of the app and found the app's menu informative and easy to operate. However, the weakness of the application is that it is difficult to access in conditions of no or minimal signal.

Table 3. Experts Opinion Toward Dehy Pro Application

Aspect	Positive comment	Negative comment
Application view	Interesting, good enough; the use of contrasting text and color selection makes the application menu and information available easy to read and see clearly; and the application is easy to operate.	Should be made without transparency so that it is easy to read by people who are older.
Language used	Communicative and easy to understand, the language used is standard and easily understood by ordinary people.	The language used is clear and easy to understand, but there is some non-uniform text formatting.
Application menu	The menu that is in accordance with the principles of nursing care, and the references used are also relevant, referring to MTBS. There is an assessment including filling in the child's profile, screening for diarrhea and dehydration, which is then equipped with a diagnosis in the form of risk of diarrhea and degree of dehydration, recommendations for treatment (intervention plan), and evaluation with further contact with pediatric nurses. Dehy pro is quite informative by providing information related to diarrhea and diarrheal dehydration.	Applications It would be more useful and practical if it were only in the form of a website-based application because the distribution mechanism would be easier. In addition, the website is easier to spread via social media.
Ease of using the application	In general, the application is very easy to use, ordinary people can use this application very easily	If accessed in an area with minimal signal, it will be a little difficult to use the application

Discussion

Dehy Pro received a positive rating with a mean of more than 6 for almost all items. Respondents from both experts and mothers with children mostly rated the application as easy to use, satisfied with the application, and beneficial to their health. In this case, parents could be helped in the initial management of diarrhea. Respondents also rated quite highly on the item "will use this application

again". This is in line with research by Wu et al. (2022), who found that satisfaction can positively influence someone to keep using the mobile health application. As it can be seen from figure 1.

As shown in image 1 on the first page of the application, each feature is presented in clear, simple language to ensure users can easily follow the instructions. Starting from the home page, users are guided to create an account by entering their full name and telephone number, differing from most applications that require an email address. This approach was chosen because most respondents had only a high school education and might not have an active email address. Once logged in, users can fill out a child's profile by providing the child's name, gender, and date of birth. After completing the child's profile, users can independently screen for the risk of diarrhea and dehydration by answering short, straightforward questions using a checklist, allowing for quick completion. Upon finishing all questions, users receive information on initial treatments to perform at home based on the type of dehydration the child is experiencing. The application ensures that all information and instructions are written in easily understandable sentences, suitable even for laypeople. Additionally, the app provides a nurse's contact number for users with questions. These features contribute to users rating the application as easy to use.

Arbicare is an application that was developed to improve diarrhea prevention behavior in preschool-age children (Arbianingsih; Rustina, Yeni; Krianto, Tri; Ayubi, 2018). An application has also been developed to provide information to parents regarding food and mineral needs for children with diarrhea (Saurina, 2016). The uniqueness of Dehy Pro compared to other applications that have ever existed is that it is the first smartphone-based application in Indonesia that focuses on preventing dehydration due to diarrhea and is equipped with a self-screening feature in the form of questions that parents can fill in independently according to signs of dehydration that may be found in children when they have diarrhea. To be able to accurately assess whether there are signs of dehydration, parents are provided with information regarding signs of dehydration based on their degree and how to carry out simple physical examinations on children, such as how to check abdominal skin turgor to detect a children's hydration status.

After the parents have completed filling out the degree of dehydration screening, a screening result will appear that concludes the degree of diarrhea dehydration experienced by children, and then several recommendations for treatment that parents can give will appear. Dehy Pro is not being developed to replace the role of health workers; on the contrary, with mothers being able to screen for dehydration independently as early as possible, mothers will make decisions more quickly about when to take their children to the nearest health service. So, it is hoped that with this application, there will be no more children with diarrhea who are late for medical help or taken to the hospital when they are already in a state of severe dehydration. The purpose of making this application is in line with Rahimi et al. (2017), who state that one of the benefits of having a mobile health application is that it can increase the role of the community in making decisions related to their health.

According to Wang & Qi (2021), the main function of a mobile health application is to provide quality health information according to user needs. Tuman & Moyer (2019) showed that the quality of information available in applications is an important factor in user acceptance of mobile health applications. Quality information can be measured in three aspects: accuracy, relevance, and up-to-dateness. In line with the statement above, the information on Dehy Pro was developed by researchers using credible literature and the management of dehydration according to the Integrated Management of Sick Children published by the Ministry of Health of the Republic of Indonesia. It is hoped that with this application, users will not experience confusion or get the wrong information from sources whose credibility is not guaranteed.

Previous research stated that people tend to accept an application that is not only easy to use but also functional and well designed (Armstrong, 2015; Mendiola et al., 2015). Based on comments from expert respondents, the information contained in Dehy Pro is considered communicative and can be easily understood, including by ordinary people. This is in line with the relatively high mean value for the questionnaire items, which states that this application is very informative and all information is well organized. In addition to the functionality aspect, the aesthetic aspect is an important category for assessing the quality of the mHealth application, which includes layout, graphics, and visual appeal (Bardus et al., 2019). Regarding the appearance aspect of the application, according to the respondent, Dehy Pro has an attractive appearance with a choice of contrasting colors so that all information is easy for users to see and read. The appearance of the application has a children's nuance, so that it is in accordance with the use of the application, namely to improve the health aspects of children. Dehy Pro's educational menu has been equipped with several interesting educational videos so that users will more easily understand the information conveyed.

This research certainly has limitations. This research was only conducted in one village in Jember Regency. Future research is expected to involve more mothers with children under five from various regions in Jember Regency so that the evaluation of the use of Dehy Pro is more representative. Dehy Pro also needs to be introduced to more layers of society so that the prevention of diarrhea and dehydration is more maximal, and in the future, Dehy Pro should be uploaded via the Play Store. Researchers will carry out application development based on inputs provided by respondents and the need to add several menus that can increase the functionality and attractiveness of the application.

Conclusion

Dehy Pro, as the first mobile health application developed for educational media for parents in preventing dehydration and diarrhea in children, has good usability and acceptance, as evidenced by the score on almost all MAUQ items above 6. Respondents stated that this application was easy to use, had an attractive appearance, the language used was easy, and was informative in the prevention of diarrhea and diarrheal dehydration in children. With several developments to improve the application, Dehy Pro can be a promising and effective educational medium for increasing the role of parents in preventing dehydration and diarrhea and can be implemented for a wider community.

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